

Abstract of the Invention

A method of creating a highly conductive transparent layer on a substrate without subjecting the substrate to high temperatures is disclosed. Pulsed laser energy of a wavelength and 5 energy fluence within a selected range is used to crystallize a selected amorphous material using a low number of pulses (optimally as few as one) to form highly electrically conductive thin films that are optically transparent at visible wavelengths. This method does not subject the substrate to sustained higher temperatures and accordingly is particularly suitable for making transparent conductive thin film structures on substrates such as plastic that do not tolerate sustained higher processing temperatures. The disclosed method may also be useful in manufacturing processes in which the substrate is composed of a material (such as glass, for example) that is itself heat tolerant, but in which at the time of creation of the conductive layer is a part of a structure containing a material that does not withstand high temperatures, such as a low temperature plastic or other polymer. A thermal barrier comprised of an oxide, nitride or polymer material may be deposited on the substrate before the precursor material to help insulate the substrate from the thermal effects of the energy directed at the precursor material.